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SCHOOL PERFORMANCE AND THE EDUCATION SYSTEMS' EFFICIENCY: AN INTERNATIONAL COMPARISON BASED ON OECD PISA SURVEYS

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ABSTRACT

Public expenditure on education has long been considered, through the accumulation of human capital, as a factor of the efficiency of educational policies. Nevertheless, empirical evidence shows that for an equal level of investment, the returns of education systems differ from one country to another. Several factors are involved. Corruption is increasingly being examined. Indeed, corruption has two facets: a direct effect through influencing students' motivation and an indirect one through mismanagement of public expenditure. A hierarchical clustering analysis and a repeated analysis of variance of a data taken from the OECD PISA surveys indicate that classifying countries as low or high performance countries is a function of their rank on the corruption perception index.

***KEYWORDS*:** *School Performance, PISA, Hierarchical Clustering, ANOVA, Efficiency*

Article History

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INTRODUCTION

Technological changes and markets' globalization have contributed to changing the economy's direction. This latter has become more technology-oriented. This gradual substitution of natural resources with information technologies, as an engine of economic development, makes human capital a ubiquitous element while discussing economic policies. With an intense international competition, the needs of international skilled labor are becoming domestic priorities and highlighted the role of education in promoting development. The literature focuses on the relationship between education expenditure and the education systems' efficiency, while empirical findings show that for an equal level of investment, the education systems' returns differ from country to another. Different questions are raised:

What makes an education system persist in the production of low or high performance scores? What makes very different educational systems produce the same performance levels?

Is there a relationship between perception of corruption and losses on public education expenditure?

To answer these different questions, we will comparatively examine the education systems of a sample of countries participating in OECD PISA surveys. The method adopted is purely exploratory. Our focus is the Tunisian education system.

Endogenous growth theory opened new perspectives in defining technical progress and offered new insights into its origins and its role in stimulating growth. Endogenous growth theorists examined different types of capital. Accumulation of these types of capital stimulates growth through productivity gains generated by each investment.

Different investment types are mentioned in the literature: Investment in physical capital, investment in technological capital and investment in research and development (Romer 1986)[1]; investment in human capital and education (Lucas 1988)[2]; investment in public capital and institutional capital and the government's role (Barro1990)[3].

T. Schultz (1961)[4] and G. Becker (1964) point to the important role of education and training in improving productivity. Accumulation of human capital, in particular by investing in education and health, determines the differences in productivity and income, brings to the fore the notion of arbitrage and introduces social behavior in economic analysis. Education has always been considered as the main driver of knowledge accumulation and a quality human capital acquisition. Lucas' idea (1988) is grounded in the belief that an educated population (following an investment in education especially through public spending) is able to be more productive. Increase in productivity gains is a growth generator

These theoretical proposals are progressively introducing the notion of "qualified" human capital, which, through its accumulation, contributes to development and economic growth: here we refer to the "quality" of human capital. Indeed, technical progress relates to the quality of available workforce in a country: Technological development is affected by an increase in skilled labor supply (Acemoglu D. 2002)[5].

Increase in human capital stock in a nation is the result of an improvement in educating its population. It ensures a growth in national productivity considered synonymous with economic growth (Schultz T.1961, Denison T., 1962). Barro R.J. and Mankiw N.G. (1992) speak of "conditional convergence of rich and poor countries as a result of increased educational achievement". Education is a creator of capacity to create wealth and for agents to exercise their skills (Hugon P., 2005). Education level achieved by agents in an economy is a major tool of its success on the world economic stage.

The recent literature has brought to the fore learning quality, possibly measured by cognitive skills tests, as an outcome of schooling years. Quality of education is thought to explain differences in productivity growth between countries (Barro 2001; Woessmann 2002, 2003; Bosworth and Collins, 2003; Coulombe and Tremblay, 2006 and Jamison et al. 2007, in Hanushek and Wößmann (2010). Quality of education can be determined by the degree of the education system's efficiency, internal and external. Internal efficiency includes any variable or product that may affect the results achieved by an education system or an ongoing training program, as NACUZON SALL. H & DE KETELE J.M [1997 put it: « It is reflected in the relationship between educational inputs and academic achievement »[6]. Internal efficiency only takes into account the consequences generated by the education system (initial enrollment, success

[1] Romer P. (1986), *Increasing Return and Long-Run Growth,* Journal of Political Economy, vol 94,

[2] Lucas R.E (1988), *On the Mechanics of Economix Development*, Journal of Monetary Economics,vol 22,

[3] Barro R.J (1990), *Government Spending in a simple model of endogenous growth*, Journal of Political economy, vol 98, n°5

[4] Schultz T.W (1961), *Investment in Human Capital,* The American Economic Review, Vol. 51, No. 1, 1-17

[5] Acemoglu D.(2002), *Technical Change, Inequality, and the Labor Market,* Journal of Economic Literature, 40, mars 2002

[6] NACUZON SALL. H & DE KETELE J.M [1997], « L'évaluation du rendement des systèmes éducatifs : apports des concepts d'efficacité, d'efficience et d'équité », Mesure et évaluation en éducation, Vol. 19 n° 3, pages 119 à 142.

rate, repetition rate, dropouts, etc. (Hamidou Nacuzon Sall and Jean-Marie De Ketele, 1997)

The PISA surveys, which will be used in this study, are one of the quantitative internal efficiency assessment tools, frequently used by international organizations (UNESCO 1991, 1993, World Bank 1988, 1992; 1996, OECD 1988).

On the other hand, external efficiency relates to the external consequences (economic and social) generated by educational and training programs. This type of efficiency denotes consequences outside the education system itself (jobs generated as a result of internal efficiency, basic attitudes of the citizen, degree of commitment to research, maintenance and promotion of peace culture etc (Hamidou Nacuzon Sall and Jean-Marie De Ketele , 1997). A successful educational policy then depends on the government's capacity to consolidate the determinants of the education system's efficiency and to minimize its inefficiencies' factors.

Interest in the quality of education and the education systems' efficiency has led to the development of international tests to evaluate students' performance and achievements, encouraging participating countries to question the effectiveness and efficiency of their educational policies and to apply the appropriate reforms.

The educational production function, defined by Psacharopoulos G. & Woodhall M. (1988) as the "process by which" school inputs "are transformed into" school outputs", enables to identify the way in which the different determinants of producing the acquired capital are combined. In this "human capital" production function, researchers have often considered, as an output, academic achievement measured by a composite socio-economic index of independent variables (school variables, socio-economic variables and individual variables) (Pritchett L. & Filmer D. 1997).

In this paper, the educational production function is re-examined using school output operationalized by school performance. Such operationalization will allow us to evaluate and compare educational systems. Efficiency of these systems depends on the "quality" of school output, measured by the relationship between performance and public spending in education, reflecting the link between the implemented means and the obtained results (cost-effectiveness). This measure of performance also informs us about the education systems' internal efficiency.

The Study

Our study examines a data collected from international organizations (cited below), from which different levels of performance and country groups have been identified. Special attention is given to a group of countries with almost the same skill levels.

Database

The database includes data taken from the below sources:

- PISA[7] surveys' results of OECD of 2003, 2006, 2009 and 2012 for performance scores
- Data published by the World Bank on the used indicators and economic variables.
- The Corruption Perception Index (CPI) from Transparancy International, a civil society organization that fights against corruption.

The "Programme for International Student Assessment" (PISA) is an international evaluation scheme consisting

[7]The Programme for International Student Assessment (PISA) www.oecd.org/pisa/

of large-scale surveys series to measure 15-year-old students' knowledge and acquired knowledge. PISA allows comparing school systems efficiencies at the macroeconomic level by looking into what is invested (spending in education, among others) and its outcome (student performance).

Three disciplines are examined: Scientific culture, reading comprehension and mathematical culture.

The OECD PISA surveys provide performance scores, ranging from 1 to 1000 points, to rank the output into 6 levels: from the lowest (below level 1) where students fail to answer the most basic questions that require basic skills, to the highest (level 5 or 6 depending on the field) where the questions are at a higher level of difficulty and which the student need to have the skills to answer correctly.

Schematically:

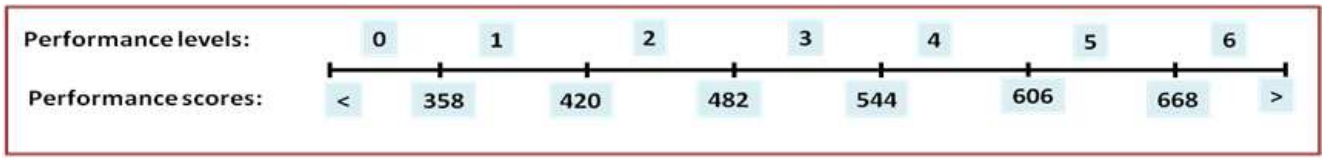

Figure 1: Performance Scores Distribution

The score of each country is calculated on the basis of the total mean scores of the participants of each sample.

We suppose that a high percentage at the higher levels (Level5 and Level6) is a sign of efficiency and conversely, a high percentage at the lower levels (Level 1 and Level 1 below Level 1) is synonymous with inefficiency.

The database consists of 40 countries. For the 40 countries, we considered the performance scores provided by the four PISA surveys (2003, 2006, 2009 and 2012). These scores are subdivided according to "Lower Levels" and "Upper Levels".

Performance Groups Detection

In order to conduct a comparative study between education systems of different countries and, more specifically, between the performance levels of different countries, we analyzed the data collected from the PISA surveys of 2003, 2006, 2009 and 2012.

The aim is to classify countries in terms of school output, to form homogeneous groups and to analyze the characteristics of these groups by integrating various determinants into the educational production function.

For the 40 countries of the sample, we performed a multi-step exploratory analysis and a hierarchical bottom-up classification by considering performance levels. The results on the distribution of student’s percentages into the different performance levels are illustrated in individual graphs. The superposition of these graphs reveals three distinct groups of countries with homogeneous tendencies: The worst performers represent the countries with the lowest levels of academic achievement (Low Level "LL"), medium performers (Medium Level "ML") and the highest performers (High Level "HL") representing countries with a high level of performance.

Graphically:

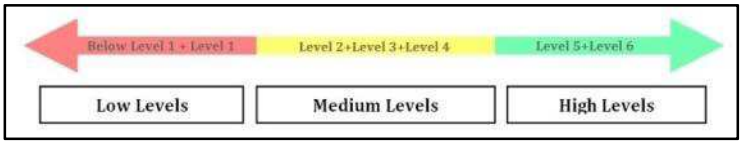

Figure 2: Performance Levels' Classification

Graphic Representations

The performance scores obtained from the PISA 2003, 2006, 2009 and 2012 surveys and the different disciplines (scientific culture, mathematical culture and reading comprehension) are represented in overlapping graphs (see Graphs 3, 4 and 5 below).

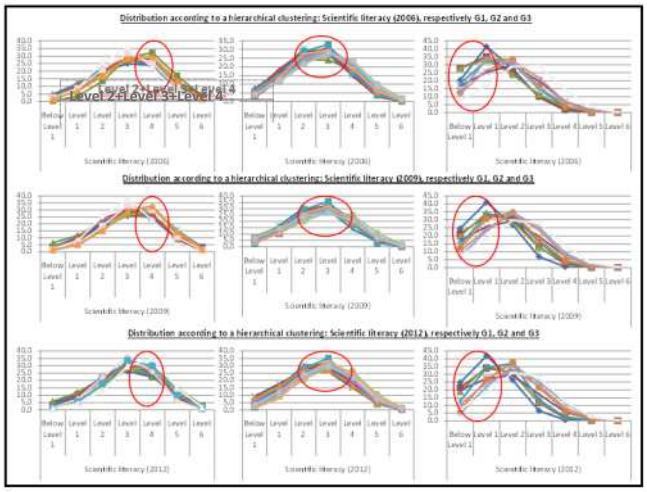

Figure 3: Distribution According to AHC (Scientific Literacy)

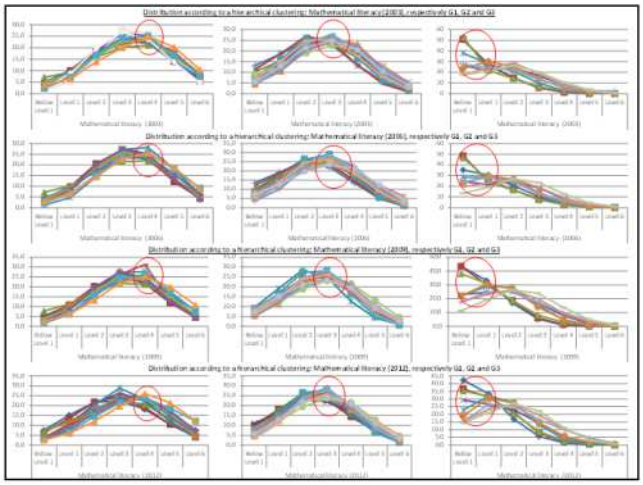

Figure 4: Distribution According to AHC (Mathematical Literacy)

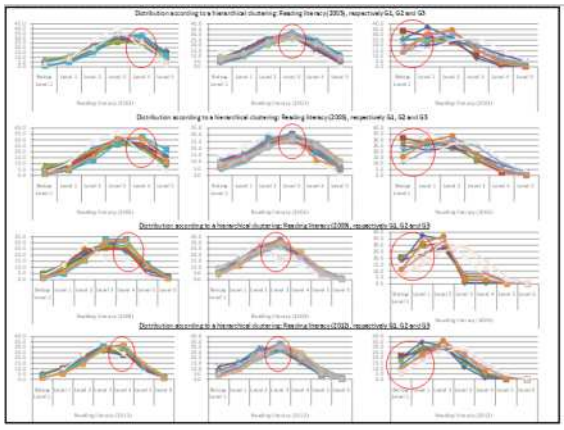

Figure 5: Distribution According to AHC (Reading Literacy)

The graphs show that, on the one hand, the studied countries are distributed across three distinct groups according to the asymmetry of the scores distributions and, on the other hand; the same characteristics persist across the four surveys.

To confirm the graphical results we used:

- Repeated analysis of variance (RMANOVA) to validate persistence over time
- Ascending Hierarchical Clustering (AHC) to confirm presence and group clustering.

In addition, only the mathematical culture was chosen in this study because of the importance of mathematical and statistical tools in the study and interpretation of any phenomenon.

Persistence through Surveys: Repeated-Measures Analysis of Variance (RMANOVA)

The RMANOVA's procedure is adopted if for each "individual" of the considered sample several measurements are collected. It makes it possible to test the difference between several means estimated on the same individuals to test the impact of the "measurement time" factor.

Our aim is to see if lower performance levels in mathematical culture for each country differ significantly from the average of the PISA surveys (2003, 2006, 2009 and 2012): The repeated measures ANOVA is thus carried out to confirm the stability of the groups through the four surveys.

RMANOVA makes it possible to distinguish variance due to the retained factor, i.e. performance scores (inter-treatment variance) and variance resulting from all the other uncontrolled factors (intra-treatment). Inter-treatment variance can be divided into inter-country variability (individuals are different from each other) and intra-country variability (under the same conditions, the same subject rarely reproduces the same result, these variations result from other factors than performance scores).

The use of RMANOVA requires the presence of some fundamental conditions. The independence of the data within each measurement time window and the normality of the differences between two measurement time windows are checked.

To test the Sphericity of the variance-covariance matrix, the Mauchly test[8] is used (see Annex1: Table 1).

The sphericity condition is respected (p-value greater than 5%).

To remedy for the lack of robustness of this test, we used the corrections of Greenhouse-Geisser and Huynh-Feldt and performed the Bonferroni's post-hoc test for a posteriori[9] multiple comparisons (Annex2: table 2).

Lower scores in mathematics are not significantly different across the four surveys.

A pairwise comparison (Annex3: table 3) shows that he scores are significantly equal between the pairs of surveys (p values all higher than 5%), differences in means are significantly negligible. The test confirms the Fisher test results.

Groups Confirmation: Hierarchical Clustering and in Dynamic Clouds

The presence and belonging of the countries to the groups observed in the graphs is confirmed by the Ascending Hierarchical Clustering (AHC) method and that in dynamic clouds.

The Ascending Hierarchical Clustering (AHC) method is applied to the selected sample of countries using the Ward criterion and the Euclidean distance square. The hierarchical tree obtained (see Graph 6) makes it possible to distinguish, at its base, four performance groups. A break at a higher level, without significant loss of information, brings them back to three.

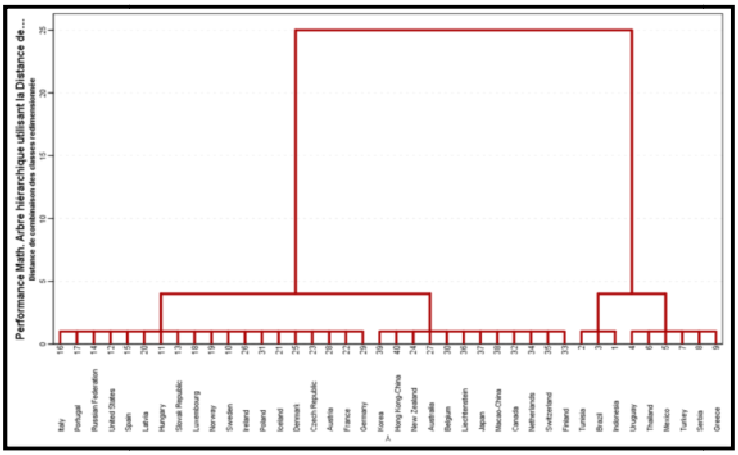

Figure 6: Hierarchical Tree (Performance Levels in Mathematical Literacy)

The use of the K-Means method or in dynamic clouds (Annex4: Table 4) confirms the results obtained by the AHC. With both methods, the obtained performance groups (representing the lower, middle and higher levels) are similar to those observed a priori in the graphical representations.

According to the obtained performance levels, we distinguish a first group of 9 countries with low performance levels (Low Level "LL") represented by a red square, a second group (Medium Level "ML") consisting of 19 countries with average performances and illustrated by a yellow circle, and a third group (High Level "HL") of 12 countries with

[8] Conditions required for more than two measurement times. The sphericity condition of the variance-covariance matrix requires that the variances of the differences for all pairs of factor modalities are similar. This condition is fulfilled if the variances of the different treatments are similar and if the covariances between the different treatments are equal. These conditions are checked using Mauchy sphericity test)

[9] This test is used instead of the Tukey test used in the one-way ANOVA.

high performance levels and represented by green triangles (annex5: Table 5).

Geographically:

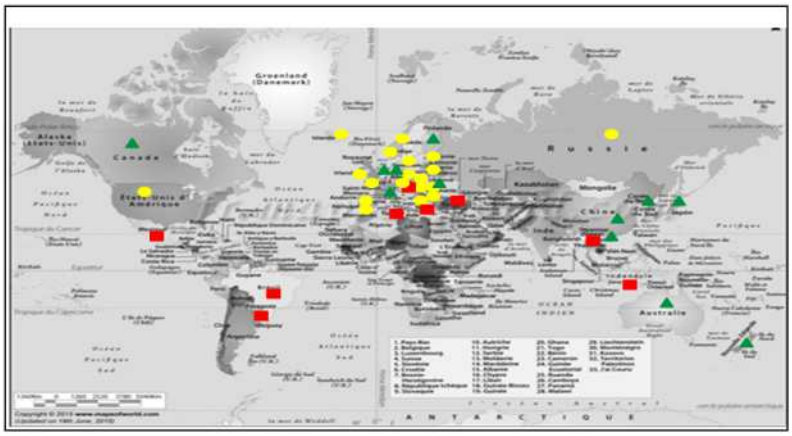

Figure 7: Geographical Distribution of Country Groups

Focus on TIB[10] Subgroup

The present study focuses on Tunisia, Indonesia and Brazil. Indeed, in hierarchical iterations, even in dynamic clouds (Chart 8 and Table 6).

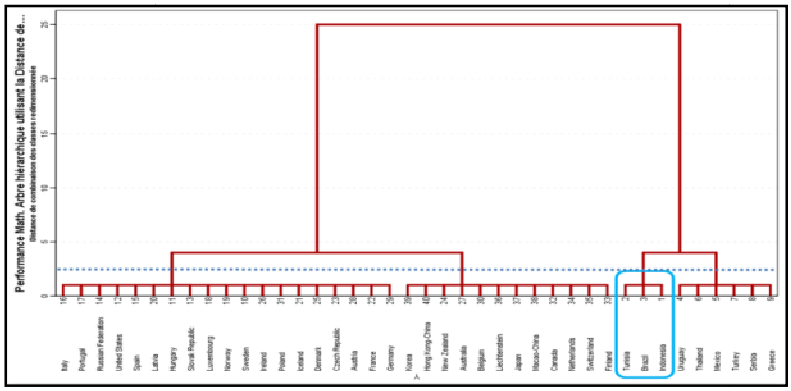

Figure 8: Hierarchical Tree « TIB » (Performance Levels In Mathematical Literacy)

Table 6: Classification Results « TIB » With the K-Means Method

Belonging to the class			
Observations number	Country	Class	Distance
1	Indonesia	1	3,078
2	Tunisia	1	3,524
3	Brazil	1	5,932
4	Uruguay	2	10,760
5	Mexico	2	21,945
6	Thailand	2	11,923
7	Turkey	2	9,401
8	Serbia	2	12,329
9	Greece	2	25,603
10	Sweden	3	11,925
11	Hungary	3	15,516
12	United States	3	19,642
13	Slovak Republic	3	11,015
14	Russian Federation	3	25,361
15	Spain	3	18,546
16	Italy	3	26,651
17	Portugal	3	24,917
18	Luxembourg	3	13,094
19	Norway	3	11,455
20	Latvia	3	18,115
21	Iceland	3	6,214
22	France	3	7,910
23	Czech Republic	3	7,415
24	New Zealand	3	9,958
25	Denmark	3	8,247
26	Ireland	3	11,922
27	Australia	3	7,866
28	Austria	3	6,262
29	Germany	3	5,962
30	Belgium	3	14,683
31	Poland	3	11,092
32	Canada	3	15,016
33	Finland	3	24,766
34	Netherlands	3	17,395
35	Switzerland	3	17,694
36	Liechtenstein	3	18,974
37	Japan	3	19,204
38	Macao-China	3	17,860
39	Korea	3	30,798
40	Hong Kong-China	3	36,156

The closet countries clustering in a low performing sub-group are respectively: Indonesia, Tunisia and Brazil

[10] Tunisia, Indonesia and Brazil

The performance graphical representation of the three countries confirms this result.

Graphic Representations

Performance distribution of the three countries through the four PISA surveys, are almost similar, mainly for the middle and higher levels (Level 3 to 5) and in all disciplines (see Graphs 9, 10 and 11).

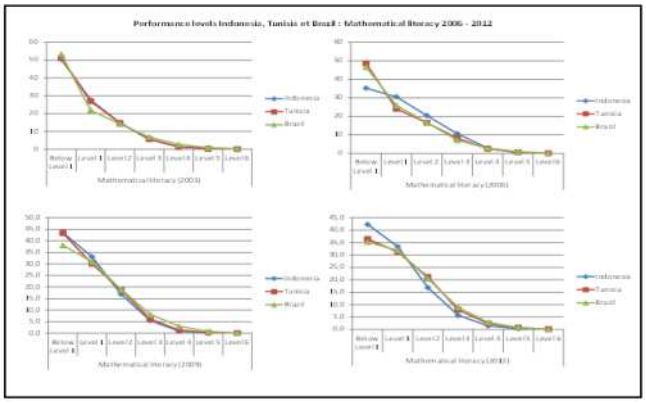

Figure 9: Performance Levels in Mathematical Literacy for the "TIB" Case: 2003-2012

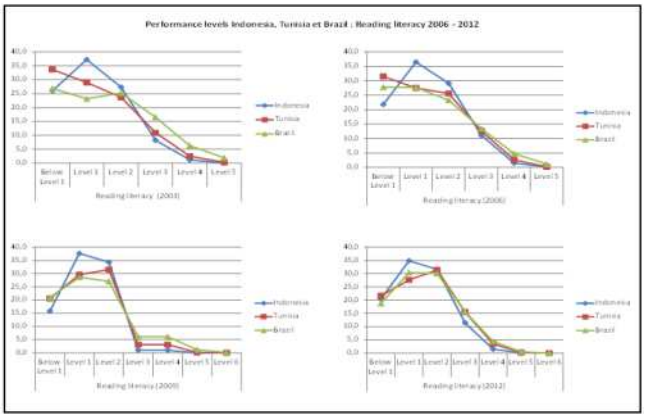

Figure 10: Performance Levels n Reading Literacy for the "TIB" Case: 2003-2012

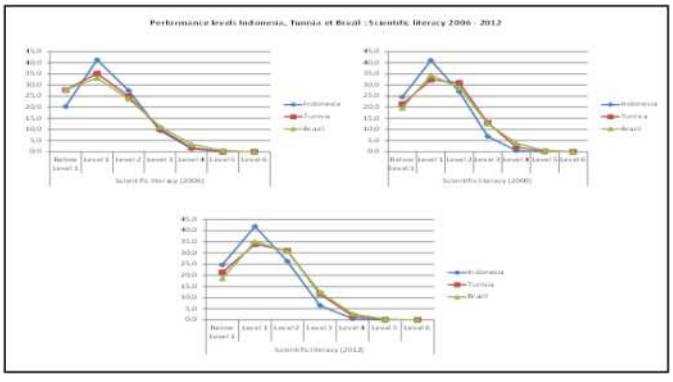

Figure 11: Performance Levels in Scientific Literacy for the "TIB" Case: 2003-2012[11]

However, the spatial location of these three countries shows that they are located in three distinct continents

[11] The 2003 session of the PISA survey doesn't include the "Scientific literacy"

(see Chart 12) and present a different socio-cultural environment.

Figure 12: Geographical Location « Tib »

The search for common factors likely to explain this performance similarity is made by examining the GDP percentage of public expenditure on education.

Share of Public Expenditure on Education in GDP Percentage: Case "TIB"

A typological analysis is carried out on the series of public expenditure on education of the sample countries in the studied period.

The hierarchy tree below (Figure 13) shows the AHC results.

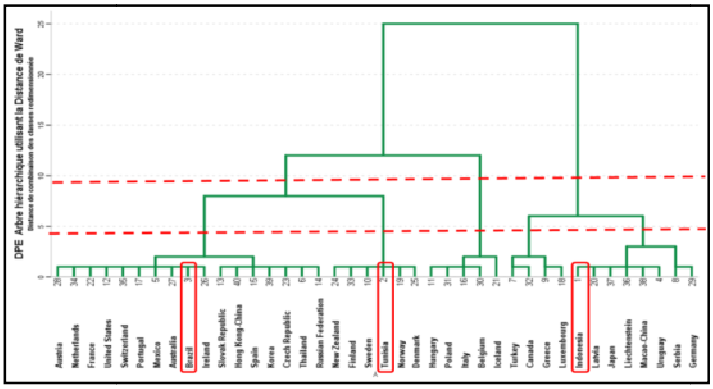

Figure 13: Hierarchical Tree "TIB" (Share of Public Expenditure on Education as a Percentage of GDP)

Indonesia and Brazil belong to the same expenditure cluster (Cluster 1) whereas Tunisia is in a different one (Cluster 2). The dynamic cloud method (Table 7) confirms these findings:

Table 7: Classification Results « TIB » With the K-Means Method

Belonging to the class

Observations number	Country	Class	Distance
1	Indonesia	1	2,570
2	Tunisia	2	,907
3	Brazil	1	2,368
4	Uruguay	1	3,165
5	Mexico	1	1,580
6	Thailand	1	1,560
7	Turkey	3	1,805
8	Serbia	3	6,284
9	Greece	3	2,804
10	Sweden	2	,701
11	Hungary	1	4,143
12	United States	1	2,081
13	Slovak Republic	1	1,209
14	Russian Federation	1	1,409
15	Spain	1	,686
16	Italy	1	3,792
17	Portugal	1	1,922
18	Luxembourg	3	3,828
19	Norway	2	,834
20	Latvia	1	2,083
21	Iceland	1	6,337
22	France	2	2,234
23	Czech Republic	1	,868
24	New Zealand	2	,884
25	Denmark	2	3,134
26	Ireland	1	2,449
27	Australia	1	1,262
28	Austria	1	2,432
29	Germany	1	4,574
30	Belgium	1	4,611
31	Poland	1	3,944
32	Canada	3	3,851
33	Finland	2	,602
34	Netherlands	1	2,391
35	Switzerland	1	2,059
36	Liechtenstein	3	1,771
37	Japan	1	2,108
38	Macao-China	3	2,681
39	Korea	1	1,092
40	Hong Kong-China	1	1,010

Indeed, the graphical representation of the sampled countries' public expenditure on education across the four PISA surveys (Figure 15) shows that Tunisia's public expenditure percent of GDP exceeds that of OECD countries and meets that of high performing countries (Group 3) (Denmark, Norway, Ireland, Sweden ...). Indonesia and Brazil, on the other hand, remain in the lower spending group.

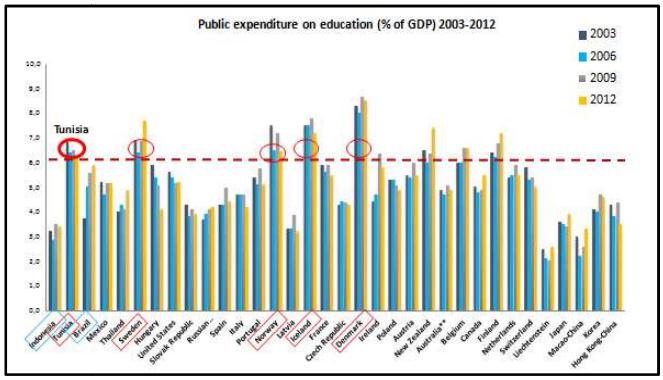

Figure 14: Share of Public Expenditure on Education as a Percentage of GDP (2003-2012)

The above finding raises a problem of inefficiency of educational policies in Tunisia that can be explained by several factors. Corruption is increasingly examined in the literature.

The Corruption Perception Index for the "TIB"

Impact of corruption on school performance results either from its direct effect, by acting on students' motivation, or from its indirect effect through mismanagement of public expenditure on education.

Mokaddem (2010) examines the mechanisms by which corruption can hinder educational achievement and pointed to the direct and indirect effects of corruption on education. His results show that by reducing spending effectiveness on education, corruption neutralizes its impact on educational outcomes.

Public Expenditure Tracking Surveys (PETS) provide service delivery surveys and citizen assessment cards as new ways allowing for assessing corruption in the education sector. The International Institute for Educational Planning report (2011) provides detailed descriptions. PETS provide public expenditure on education loss estimates through

"information on the percentage of funds spent at each hierarchical education level, the targeting of funding between different schools and sub-populations, as well as information on school facilities, quality of teachers' work and absenteeism, drop-out rates, exam scores, school management and accountability descriptions" Romuald Normand (2005).

Classifying countries in terms performance levels seems to correlate directly with the perceived level of corruption. The world map below (Chart 15) shows Transparency International's Corruption Perception Index in 2012. A high score (yellow) indicates a low level of perceived corruption, which represents a high transparency level. A low score (red) indicates a high degree of perceived corruption.

Figure 15: Distribution of the CPI on the World Map

Using the same Ascending Hierarchical Clustering (HAC) and dynamic cloud methods, CPI distribution analysis classifies Tunisia, Indonesia and Brazil in the same group. These three countries therefore have similar perceived corruption rates across the different surveys (Chart 16 and Table 8).

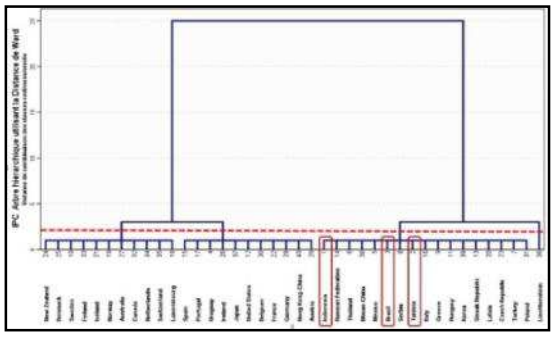

Figure 16: Hierarchical Tree « TIB » (Corruption Perception Index)

Table 8: Classification Results « TIB » With the K-Means Method

Belonging to the class

Observations number	Country	Class	Distance
1	Indonesia	2	2,903
2	Tunisia	2	1,391
3	Brazil	2	,770
4	Uruguay	3	3,582
5	Mexico	2	1,350
6	Thailand	2	1,034
7	Turkey	2	,924
8	Serbia	2	1,824
9	Greece	2	1,061
10	Sweden	3	2,084
11	Hungary	2	2,301
12	United States	3	1,411
13	Slovak Republic	2	,918
14	Russian Federation	2	2,965
15	Spain	3	3,074
16	Italy	2	1,883
17	Portugal	3	3,574
18	Luxembourg	3	,668
19	Norway	3	1,178
20	Latvia	2	1,057
21	Iceland	3	2,097
22	France	3	2,066
23	Czech Republic	2	1,354
24	New Zealand	3	2,581
25	Denmark	3	2,479
26	Ireland	3	1,451
27	Australia	3	1,186
28	Austria	3	1,054
29	Germany	3	,530
30	Belgium	3	1,515
31	Poland	2	1,792
32	Canada	3	1,017
33	Finland	3	2,481
34	Netherlands	3	1,312
35	Switzerland	3	1,590
36	Liechtenstein	1	,000
37	Japan	3	1,458
38	Macao-China	2	,941
39	Korea	2	2,336
40	Hong Kong-China	3	,270

To better determine the multi-variate interrelations between Performance levels, public spending on education percent of GDP and Corruption Perception Index, we performed a principal component analysis (PCA).

Factor Analysis

PCA is applied on all the countries of the sample, using an “Individual-Variables” table, the different performance scores, public expenditure on education (DPE) and the Corruption perception index (CPI).

After validating the use of PCA on the selected database (KMO index, Bartlett test and correlation matrix), a three-dimension factorial space is retained. This space explains 86% of total variance. A first component "School Performance" explains 44% of total variance. This component plots higher performance levels (positive side) against lower levels (negative side). A second component "Corruption" explains 24% of total variance. It plots high transparency levels (high CPI in the positive direction) against lower ones (negative direction). A third component "Education Expenditure" explains 18% of total variance. In this component, the highest spending countries are on the positive side of the axis. The graph below (Chart 17) illustrates the first factor which explains 68% of total variance.

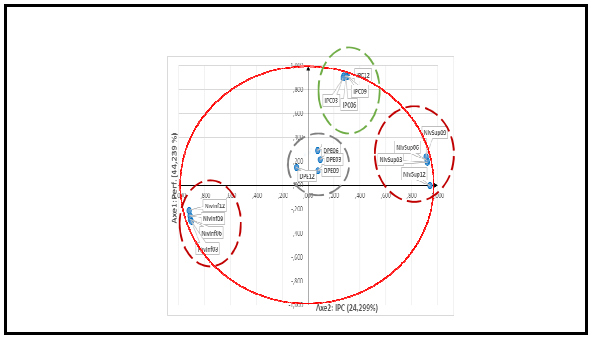

Figure17: First Factorial Plan

Education expenditure is not discriminated in this first factor. The graphical representation of the "CPI versus Expenditure" component (Figure 18) plots the corruption perception indices against public expenditure on education.

This subspace explains 42% of total variance.

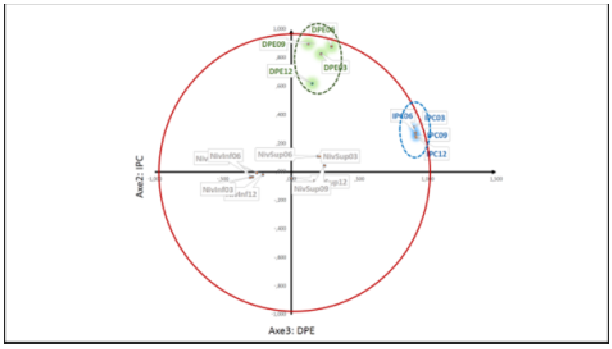

Figure 18: Factoriel Plan PEE[12]/CPI

Clustering the sampled 40 countries into the three factors (Charts 19, 20 and 21) confirms the classification of the AHC and dynamic clouds methods.

In particular, Tunisia, which belongs to the low performing and low-transparency group (Indonesia and Brazil) when the "academic performance" criterion is used, switches to the high-performing group (Denmark, Sweden,) when the "Education expenditure" criterion is used.

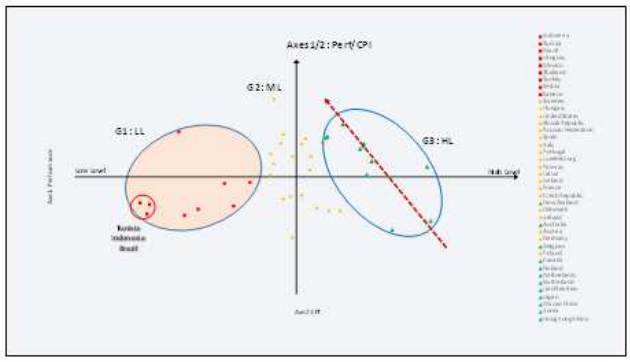

Figure 19 : Distribution Performance/CPI

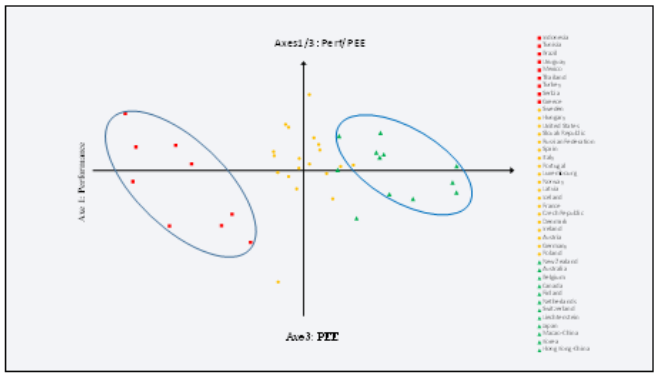

Figure 20 : Countries Position (Performance/PEE)

[12] Public Education Expenditure

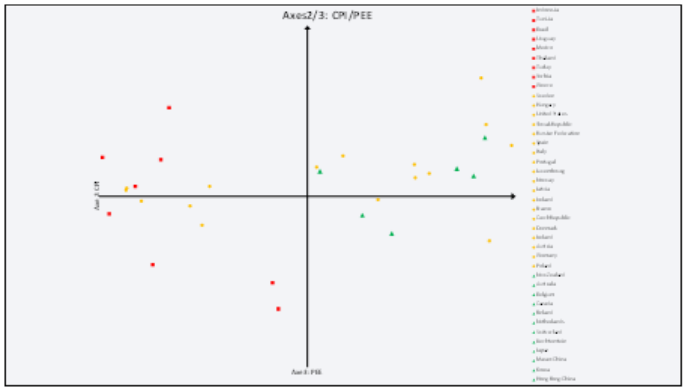

Figure 21: Countries Position (CPI/PEE)

This finding confirms the initial assumption about public spending inefficiency due to corruption and the educational systems' governance inefficiency.

CONCLUSIONS

The PISA surveys results on the academic performance of students in different education systems reveal three distinct performance groups (high, medium and low). This typology persists through surveys and disciplines. One might wonder if there is a kind of stigmatization of educational systems as poorly or very poorly performing.

Public expenditure on education distribution shows that it is not a sufficient condition for academic performance. High expenditure on education may be the result of low performance (as is the case in Tunisia). Expenditure on education in Tunisia (with the lowest school performance level) is similar to that of countries with a high academic achievement level. A causality study should be conducted to examine the efficiency of Tunisian educational policies.

The TIB (Tunisia, Indonesia and Brazil) sub-group, which have almost similar performance levels, has different geographical, economic and socio-cultural characteristics. These three countries have a common explained factor and belong to the same cluster with respect to their corruption perception index. In addition to public spending on education, perception of corruption seems to explain more school performance.

This study is an exploratory analysis of students' school performance in the surveyed countries, expenditure on education and perception of corruption and found strong interrelationships. It would be interesting in the future to model the results on school performance and groups by integrating other independent variables and to evaluate more thoroughly efficiency of the educational policies adopted by these different countries, using other methods like instrumental variables, matching...etc. This kind of research should go beyond the exploratory logic adopted in this study.

REFERENCES

1. *Lucas R.E (1988), On the Mechanics of Economic Development, Journal of Monetary Economics, vol 22.*
2. *Barro R.J., Mankiw N. & Sala-i-Martin X. (1992), Capital mobility in Neoclassical Models of Growth, National bureau of economic research (Cambridge, MA), working paper N°4206, November.*
3. *Bosworth and Collins (2003), The Empirics of Growth: An Update, Brookings Institution*
4. *Hugon, P. (2005), La scolarisation et l'éducation catalyseurs du développement. Analyses théoriques et tests empiriques, DET/ FORUM, Colloque ATM Marrakech, Avril.*

5. *Hanushek E A and Wößmann L (2010), Education and Economic Growth, In: Penelope Peterson, Eva Baker, Barry McGaw, (Editors), International Encyclopedia of Education. Volume 2, pp. 245-252. Oxford: Elsevier.*
6. *Psacharopoulos G. et Woodhall M. (1988), L'éducation pour le développement : une analyse des choix d'investissement, Economica Paris.*
7. *Pritchett L. and Filmer D. (1997), what educational production functions really show: a positive theory of education spending, Policy research working paper 1795, the World Bank, July.*
8. *Programme international pour le suivi des acquis des élèves PISA. www.oecd.org/pisa/.*
9. *Greenhouse S.W. and Geisser S. (1959), Methods in the analysis of profile data, Psychometrika, 24, 95-112. Huynh-Feldt, L.S. (1976), Estimation of the Box correction for degrees of freedom from sample data in randomized block and split-plot designs, Journal of Educational Statistics, 1 (1), 69-82.*
10. *Mokaddem L. (2010), La corruption compromet elle la réalisation de l'éducation pour tous?: les canaux de transmission,http://jaga.afrique-gouvernance.net/_docs/a_lamia_mokade.pdf*
11. *Poisson M. (2011), Corruption et éducation, académie internationale de l'éducation, Institut international de planification de l'éducation, n°11, www.iiep.unesco.org*
12. *Romuald Normand (2005), La mesure de l'efficacité de l'éducation comme outil de décision, Cahiers de la recherche sur l'éducation et les savoirs, Hors-série n° 1, pp. 135-137.*

APPENDICES

Table 9: Mauchly Sphericity Test

Test de sphéricité de Mauchly[b]

Mesure:S11

Effet intra-sujets	W de Mauchly	Khi-deux approché	ddl	Sig.	Epsilon[a]		
					Greenhouse-Geisser	Huynh-Feldt	Borne inférieure
AnnéeEnquête	,836	5,895	2	,052	,859	,901	,500

Teste l'hypothèse nulle selon laquelle la matrice de covariance des erreurs des variables dépendantes orthonormées est proportionnelle à la matrice identité.

a. Peut être utilisé pour ajuster les degrés de libertés des tests de signification centrés. Les tests corrigés sont affichés dans le tableau des Tests des effets intra-sujets

b. Plan : Ordonnée à l'origine
Dans le plan des sujets : AnnéeEnquête

Table 10: Intra-Subject Effects Tests

Tests des effets intra-sujets

Mesure:S11

Source		Somme des carrés de type III	ddl	Moyenne des carrés	D	Sig.	Eta au carré partiel
AnnéeEnquête	Sphéricité supposée	16,519	2	8,260	1,020	,366	,029
	Greenhouse-Geisser	16,519	1,719	9,611	1,020	,357	,029
	Huynh-Feldt	16,519	1,802	9,169	1,020	,360	,029
	Borne inférieure	16,519	1,000	16,519	1,020	,320	,029
Erreur(AnnéeEnquête)	Sphéricité supposée	550,527	68	8,096			
	Greenhouse-Geisser	550,527	58,440	9,420			
	Huynh-Feldt	550,527	61,256	8,987			
	Borne inférieure	550,527	34,000	16,192			

Table 11: Pairwise Comparisons

Comparaisons par paire

Mesure:S11

(I) AnnéeEnquête	(J) AnnéeEnquête	Différence des moyennes (I-J)	Erreur standard	Sig.[a]	Intervalle de confiance de la différence à 95%[a]	
					Borne inférieure	Limite supérieure
1	2	-,280	,586	1,000	-1,756	1,196
	3	-,946	,804	,744	-2,972	1,080
2	1	,280	,586	1,000	-1,196	1,756
	3	-,666	,630	,895	-2,253	,921
3	1	,946	,804	,744	-1,080	2,972
	2	,666	,630	,895	-,921	2,253

Basée sur les moyennes marginales estimées

a. Ajustement des comparaisons multiples : Bonferroni.

Table 12: Classification Results with the K-Means Method

Belonging to the class

Observations number	Country	Class	Distance
1	Indonesia	1	8,078
2	Tunisia	1	3,524
3	Brazil	1	5,932
4	Uruguay	2	10,760
5	Mexico	2	21,045
6	Thailand	2	11,923
7	Turkey	2	9,481
8	Serbia	2	12,329
9	Greece	2	25,603
10	Sweden	3	11,825
11	Hungary	3	15,516
12	United States	3	19,642
13	Slovak Republic	3	11,815
14	Russian Federation	3	25,361
15	Spain	3	18,546
16	Italy	3	26,651
17	Portugal	3	24,917
18	Luxembourg	3	13,084
19	Norway	3	11,455
20	Latvia	3	18,115
21	Iceland	3	6,214
22	France	3	7,910
23	Czech Republic	3	7,415
24	New Zealand	3	9,958
25	Denmark	3	8,247
26	Ireland	3	11,922
27	Australia	3	7,866
28	Austria	3	6,262
29	Germany	3	5,962
30	Belgium	3	14,683
31	Poland	3	11,092
32	Canada	3	15,016
33	Finland	3	24,766
34	Netherlands	3	17,395
35	Switzerland	3	17,684
36	Liechtenstein	3	18,974
37	Japan	3	18,204
38	Macao-China	3	17,860
39	Korea	3	30,799
40	Hong Kong-China	3	36,156

Table 13: Country Groups Distributions by Performance Levels

Groupe 1 ■ Low Level « LL »	Groupe 2 ● Medium Level « ML »	Groupe 3 ▲ High Level « HL »
Indonesia	Sweden	New Zealand
Tunisia	Hungary	Australia
Brazil	United States	Belgium
Urugway	Slovak Republic	Canada
Mexico	Russian federation	Finland
Thailand	Spain	Netherlands
Turkey	Italy	Switzerland
Serbia	Portugal	Liechtenstein
Greece	Luxembourg	Japan
	Norway	Macao-China
	Latvia	Korea
	Iceland	Hong Kong-China
	France	
	Czech Republic	
	Denmark	
	Ireland	
	Austria	
	Germany	
	Poland	